EFFECT OF FOLIAR APPLICATION OF METHANOL UNDER TWO LEVELS OF IRRIGATION REGIME ON COTTON PRODUCTIVITY

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Abstract

Two field experiments were conducted at Sids Agricultural Research Station, during 2004 and 2005 seasons, to study the response of cotton plant, Giza 80 to the application of methanol under two levels of irrigation (15 and 21 days intervals). Methanol sprayed at concentrations of (0, 5, 10, 15 and 20 % V/V) one time at the start of flowering.

Results could be summarized as follows :

1. Foliar application of methanol increased number of fruiting branches / plant, specific leaf area (SLA), number of open bolls / plant, boll weight, seed index, lint percentage, seed cotton yield per feddan, fiber fineness, fiber strength and fiber length than the control.
2. The highest values of seed cotton yield per feddan were obtained from applying methanol at the concentration of 20 % (30.29 and 24.41 %) in both seasons respectively more than the control. Also, a, b and total chlorophyll, carbohydrates and phenols in leaves and protein and oils in seeds were increased as a result of methanol application.

Exceeded irrigation interval of 21 days indicated a reduction in number of fruiting branches / plant, leaf area index (LAI), and weight (SLW), number of open bolls / plant, boll weight, seed index, lint %, yield per feddan, fiber fineness, strength and length of cotton plant (Giza 80 cultivar), and all the chemical components studied.

3. Methanol application under water stress (irrigation intervals of 21 days each) reduced the damage effect of water stress and led to an increase of chlorophyll contents, carbohydrates and phenols in leaves, this caused an increase in open bolls / plant and boll weight and effect proportionally on the yield of seed cotton / feddan.

Methanol at 20 % with 15 days interval treatment exhibited the highest values of all the pervious characteristics than those of control.

INTRODUCTION

Foliar application of methanol was used as a precursor of CO_2 on plant in many countries to enhance yield and water use efficiency of C_3 plants. Moreover, methanol foliar application was recommended to farmers for crop production in the USA (Arizona Department of Agriculture, 1993).

In Egypt, cotton area decreased gradually during the last three decades owing to the higher economic returns of other competitive summer crops, i.e., maize and rice. Efforts are concentrated only to increase cotton production per unit

area. This could be achieved by using high yielding varieties, improving the agronomic practices and assist cotton growers to the new technologies.

Foliar application of methanol had been reported to increase the yield and reduce the water requirement of C_3 crops in warm, high radiation arid climate (Nonomura and Beson, 1992). These benefits are of particular importance in Egypt to increase our seed cotton yield and to decrease the irrigation water consumed in summer season by cotton plant. Meanwhile, Abdel-Al (1998) found a significant increase in plant height, leaf area, dry weight of cotton parts, seed index, seed yield / plant and seed cotton yield / fed. by using 10, 20 and 30 % aqueous solution of methanol at flowering period. On the other hand, Mosely et al. (1994) evaluated the effect of methanol 30 % on growth of cotton under dry land and irrigated conditions at Taxes. They reported that methanol had no significant effect on growth and cotton biomass production. Barnes and Houghton (1994) in New Mexico, found that methanol increased boll number and fruiting sites of Acala cotton plants, but lint yield was adversely affected.

MATERIALS AND METHODS

Two field experiments were carried out at Sids Experimental Station, of Agricultural Research Center, Beni-sweef Governorate, Egypt, during 2004 and 2005 seasons. This investigation aimed to evaluate the effect of methanol foliar application on growth, yield, yield components, fiber quality and chemical components of cotton plants, Giza 80 variety.

Methanol (methyl alcohol, CH_3OH) was applied in four concentrations i.e., 5, 10, 15 and 20 % V/V as well as the control treatment, (spraying with tap water). Methanol was sprayed with Knapsack sprayer. Methanol spraying one time at the start of flowering. The experimental design was a split plot with four replications.

Experimental unit area was 15 m^2 and contained five ridges. Each ridge was 5.0 meters long, 60 cm width, hill space was 20 cm apart on one side of the ridge.

Calcium super-phosphate 15.5 % P_2O_5 at a rate of 150 kg / fed., ammonium nitrate (33.5 % N) at the rate of 60 kg N / fed. and Potassium Sulphate (48 % K_2O) at the rate of 50 kg / fed. were added in split applications at 1st and 2nd irrigations. The previous crop was Egyptian clover (berseem).

Seeds of cotton Giza 8o cultivar were planted on 24th and 13th of March in 2004 and 2005 seasons, respectively. Normal cultural practices for growing cotton crop as well as for weed and pest control were practiced properly as recommended in the region. Plants were thinned to secure two plants per hill.

Data recorded on the vegetative characteristics at 100 days after sowing and also, 15 days from methanol spraying. A random sample of 10 guarded cotton plants were taken from each plot to estimate the following vegetative characteristics

Number of fruiting branches per plant, leaf area (L.A.), leaf area index (LAI), specific leaf weight (SLW mg /cm^2) and specific leaf area (SLA cm^2/ cm^3).

Yield attributes data were recorded from a random sample of 10 plants per plot. Parameter was recorded on the basis of yield of the whole plot and converted to Kentar / feddan, (Kentar = 157.5 Kg). Data recorded on yield and yield attributes were as follows: average number of total open bolls per plant, boll weight (g), seed cotton yield per feddan (Kentar), lint percentage (lint %) and seed index (weight of 100 seeds "g"). Cotton fiber properties were estimated at Fiber Laboratory of Cotton Research institute (ARC) at Giza under controlled atmospheric condition of 70 ± 2°f temperature and 65 ± relative humidity, fiber elongation, fiber fineness and maturity, expressed as micronaire instrument reading. Fiber strength in g / tex by using the Pressley fiber strength. The fiber properties tests were conducted according to the A.S.T.M. (1979).

Chemical constituents

The determinations were done during (2005) only an leaves of the fourth node from the apex were taken at random at the beginning of flowering, i.e., after 15 days from the spraying of methanol. Chlorophyll (a) and (b) were determined as described by Arnan (1949), reducing sugars (A-O-A-C-,1965), total soluble sugars (Cerning, 1975), Polyphenols (A-O-A-C-, 1965), total phenols (Simons and Ross, 1971), oil content in seed was determined according to (A-O-A-C-, 1975), and protein content in seed was determined using the method described by (A.O.A.C., 1975).

The obtained data were exposed to proper statistical analysis according to Snedecor and Cochran (1981). The least significant differences (LSD) at 0.05 level of significant were calculated.

RESULTS AND DISCUSSION

A- Growth characters

I- Methanol effect

The data in Table (1) show significant differences in number of fruiting branches / plant of cotton plant due to the methanol treatments in both seasons. In respect to the effect of methanol treatments on number of cotton fruiting branches / plant, results revealed that 20 % of methanol concentration had the highest values (16.67 and 17.45) as compared to other treatment especially the control where the lowest values of cotton fruiting branches (14.20 and 14.95) in the 1^{st} and 2^{nd} seasons, respectively were observed without added methanol (control treatment). The highest

value of number of fruiting branches / plant surpassed the control treatment by 14.82 and 14.33 % in the 1st and 2nd seasons respectively. These results agree to great extents with Makhdum et al. (2002) in Pakistan, who found that foliar application of methanol resulted in stimulation of growth processes of cotton plant, increased node numbers, leaf area index and leaf turgidity. Similar results also were reported by Ombase et al. (2003), who found that plant high, number of branches / plant, number of leaves / plant were increased with the increase in methanol concentrations up to 20 %. Whereas, Abdel-Al (1998) indicated that methanol application significantly increased plant height, leaf area, dry weight of vegetative parts but not significantly effect number of leaves, internodes and fruiting branches on the main stem.

No significant effect of methanol treatments was observed on the leaf area index (L.A.I.), specific leaf area (SLA) and specific leaf weight (SLW). These results are in line with those of Nonomura and Benson (1992), Barnes and Houghton (1994), Makhdum et al. (2002) and Ombase et al. (2003).

II- Irrigation effect

Results of the effect of irrigation intervals on number of fruiting branches, LAI, SLA, SLW per cotton plant are presented in Table (1).

Irrigation intervals exerted a significant effect on number of fruiting branches of cotton plant, which were higher in normal (15 day) irrigation intervals than in longer (21 days) irrigation intervals treatments by 3.8 and 4.5 % in the 1st and 2nd seasons respectively.

Favorable irrigation (15 days) interval stimulates photosynthetic activity of cotton plant and increased number of nodes / plant and the differentiation of their buds to produce more fruiting branches. Therefore, water stress condition was correlated with reduction in number of fruiting branches / plant. Reduction in number of fruiting branches / plant under water stress conditions was also reviewed by Khan and Malik (1996). The data showed significant differences in LAI, SLW and SLA due to the irrigation intervals in both seasons. LAI value serves as an indicator of the surfaces available for light absorption and for discussing the photosynthetic potential of plant values of leaf area index (LAI), specific leaf weight and area (SLW and SLA) of cotton plants irrigated every 15 days were higher than that of plants irrigated every 21 days. This trend was quit expected since longer irrigation (21 days) intervals decreased both number of leaves / plant as well as leaf area / plant. Favourable water condition stimulate photosynthetic activity and dry matter accumulation of plant leaves more than the expansion rate of these and thus consequently increase it specific leaf weight (SLW). In this concern Gibb et al. (2004) explained that water stress has been shown to reduce leaf area and thus will obviously affect the level of total canopy photosynthesis. Photosynthesis is maintained in priority over leaf expansion and development. Response of SLA to irrigation intervals had the same trend of LAI trait (Table, 1).

Table 1. Effect of methanol foliar application, irrigation intervals and their interaction on number of fruiting branches, LAI, SIA and SLW of cotton plants (at 100 days after sowing) in 2004 and 2005 seasons.

Characteristic	branches / plant						SLA Cm^2/cm^3			SLW $M,g / cm^2$		
Irrigation intervals / Methanol concentration	15 day	21 day	**Average**	15 day	21 day	**Average**	15 day	21 day	**Average**	15 day	21 day	**Average**
1. Season 2004												
0	14.73	13.67	14.20	3.95	2.88	3.42	0.061	0.068	0.065	8.53	8.26	8.40
5	15.10	14.30	14.70	3.61	2.70	3.16	0.065	0.061	0.063	8.96	8.62	8.79
10	15.37	15.13	15.25	3.98	2.88	3.43	0.057	0.060	0.058	9.47	8.94	9.21
15	15.63	15.50	15.57	4.28	3.12	3.70	0.063	0.073	0.068	9.84	8.95	9.40
20	17.00	16.33	16.67	4.58	3.53	4.06	0.073	0.086	0.079	10.25	8.98	9.62
Average	15.57	14.99		4.08	3.03		0.064	0.066		9.36	8.81	
LSD at 5% for Treatments	0.20		0.31	0.45		N.S.	N.S.		N.S.	N.S.		N.S.
Interaction	0.44			N.S.			N.S.			N.S.		
2. Season 2005												
0	15.67	14.23	14.95	4.35	3.39	3.87	0.032	0.038	0.035	8.90	8.45	8.68
5	15.40	14.80	15.10	4.39	3.46	3.93	0035	0.035	0.035	9.11	7.48	8.30
10	15.77	15.33	15.55	4.78	3.24	4.01	0.033	0.034	0.034	9.22	7.78	8.50
15	16.80	16.27	16.54	4.39	3.75	4.07	0.045	0.035	0.038	9.37	8.19	8.78
20	17.77	17.13	17.45	4.90	3.84	4.37	0.040	0.040	0.040	9.95	8.46	9.21
Average	16.28	15.55		4.56	3.54		0.035	0.038		9.31	8.09	
LSD at 5% for Treatments	0.25		0.31	0.37		N.S.	N.S.		N.S.	0.77		N.S.
Interaction	0.41			N.S.			N.S.			N.S.		

III- Interaction

Effect of interaction between methanol treatments and irrigation intervals was not significant. Number of fruiting branches / plant, LAI, SLW and SLA were increased as irrigation water interval decreased and methanol concentration increased. Therefore, the highest values of number of fruiting branches / plant, LAI and SLW were recorded from cotton plants irrigated every 15 day and sprayed with methanol 20 % in both seasons. Higher values obtained by methanol were higher under normal than with water stress irrigation conditions in both seasons. Data obtained show that methanol application could compensate the shortage in irrigation water required for certain plant species and under certain environmental conditions. Such finding confirmed by Nonomura and Benson (1992).

B- Yield and yield components

Results in Table (2) presented the effect of methanol foliar application, irrigation regime and their interaction on number of open bolls / plant, boll weight (g), seed index (g), lint % and seed cotton yield / fed. in 2004 and 2005 seasons.

I- Methanol effect

The data revealed that spraying methanol significantly increased number of open bolls / plant, seed index and seed cotton yield / fed. in both seasons. Boll weight and lint % were not affected by methanol treatments in the 2nd season. These results agree with those reported by Barnes and Houghton (1994) who showed that methanol increased boll number and fruiting sites of Acala cotton plant. The results given in Table (2) suggested that methanol must be applied at concentration of 20 % (V / V) to obtain the optimal cotton yield / fed. under Beni-Sweef Governorate climatic conditions. These increases could be attributed to the beneficial effect of methanol on number of fruiting branches, number of bolls / plant, boll weight, seed index, lint % and their positive reflection on cotton yield / fed.

Yield improvement occurred in methanol treated plants was explained by the role of methanol as a carbon source to increase carb-oxylation reactions and enhanced photosynthetic rate of treated plant (Nonomura and Benson, (1992). Moreover, CO_2 resulting from rapid oxidation of methanol could successfully compete with oxygen for ribulose 1, 5 diphosphate and consequently depressed photorespiration rate in C_3 plant (Nonomure and Benson,(1992).Meanwhile, CO_2 release increase photosynthetic rate of treated plants, whereas the produced cytokinin stimulates translocation of minerals and organic compounds in leaves. In addition Makhdum et al. (2002) suggested that methanol foliar application improved nutritional status of treated plants by enhanced root activity engendered.

Table 2. Effect of methanol foliar application, irrigation intervals and their interaction on yield and yield components of cotton plants in 2004 and 2005 seasons.

Characteristic	Number of open bolls / plant			Boll weight (g)			Seed index (g)			Lint percentage %			Seed cotton yield (Kentar / Fedd.)		
Irrigation intervals / Methanol concentration	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average
Season 2004															
0	16.80	15.77	16.29	2.41	2.34	2.38	9.25	8.53	8.89	41.13	39.29	40.21	9.73	8.88	9.31
5	17.53	16.37	16.95	2.58	2.40	2.49	10.64	8.89	9.77	40.10	40.08	40.09	10.29	9.30	9.80
10	18.60	16.90	17.75	2.60	2.44	2.52	10.69	9.52	10.11	40.23	40.14	40.19	10.55	9.91	10.23
15	19.47	17.57	18.52	2.67	2.40	2.54	10.80	9.49	10.15	39.81	39.24	39.53	11.71	10.30	11.01
20	19.73	18.73	19.23	2.69	2.47	2.58	10.84	9.95	10.40	40.26	40.67	40.47	12.32	11.94	12.13
Average	18.43	17.07		2.59	2.41		10.44	9.28		40.31	39.88		10.92	10.07	
LSD at 5% for Treatments	0.33		0.25	0.05		0.08	0.094		0.15	N.S.		N.S.	0.19		0.30
Interaction	0.74			0.12			0.21			N.S.			0.42		
Season 2005															
0	16.63	16.17	16.40	2.63	2.32	2.48	9.47	9.16	9.32	41.56	41.15	41.36	10.78	10.36	10.57
5	17.17	16.77	16.97	2.43	2.41	2.42	9.28	9.20	9.24	40.88	40.64	40.76	11.09	10.87	10.98
10	18.73	18.03	18.38	2.47	2.48	2.48	9.38	9.30	9.34	40.01	40.83	40.42	12.07	11.97	12.02
15	19.70	19.08	19.39	2.53	2.52	2.53	9.43	9.35	9.39	40.93	40.39	40.66	12.61	12.30	12.46
20	20.53	19.90	20.22	2.68	2.66	2.67	9.65	9.54	9.60	41.22	41.40	41.31	13.21	13.08	13.15
Average	18.55	17.99		2.55	2.48		9.44	9.31		40.92	40.88		11.95	11.72	
LSD at 5% for Treatments	0.24		0.38	N.S.		N.S.	0.05		0.12	N.S.		N.S.	0.03		0.40
Interaction	0.53			N.S.			0.15			N.S.			0.30		

II- Irrigation effect

Number of open bolls / plant, boll weight, seed index, lint % and seed cotton yield/fed. were higher under 15 day irrigation interval treatment than under 21 days irrigation treatment in both seasons. Water limited treatment (21 day irrigation) gave lower values of number of fruiting branches per plant, number of open bolls / plant, boll weight, lint % and seed index and consequently lower seed cotton yield / feddan. Longer irrigation intervals (21 days) make the soil water supply not adequate to meet the transpiration demands, then plant water stress occurs and photosynthetic efficiency and dry matter accumulated per plant sharply reduced and growth and productivity were negative. In the same connection, Gibb et al. (2004) showed that the impact of water stress at different crop growth stages on final yield is directly related to the water demands expressed by the crop. They added that stress during period of high water demands could produce larger reductions in yield. Herein, stress during peak of flowering could increase yield losses as compared with early or late seasonal stress.

III- Interaction

Number of open bolls / plant, boll weight, seed index, and seed cotton yield / fed. were significantly influenced by interaction between the two studied factors, values of all the previous characteristics increased as irrigation intervals decreased and methanol spraying concentrations increased up to 20 % in both seasons.

C- Fiber quality

Results in Table (3) show the effect of methanol and foliar application, irrigation intervals and their interaction on fiber quality i.e., fineness, strength and length in 2004 and 2005 seasons.

I- Methanol effect

Results of the studied fiber quality parameters clear that fiber fineness, fiber strength and fiber length were slightly responded to foliage methanol application. Methanol foliar spray may favor carbohydrate synthesis and supplies fiber cells with sufficient amounts of cellulose to increase fiber expansion and elongation (length). Methanol may also stimulate utilization of extra carbohydrate to increase fiber cell wall thickening, leading to some in fiber strength. In this respect, Makhdum et al. (2002) showed that foliar application of methanol did not produce any significant effect on fiber length, length uniformity ratio %, fiber fineness and fiber strength. They explained that genetic and environmental factors apparently exert so much influence on quality of fiber that little effect from methanol spray could be elucidated.

Table 3. Effect of methanol foliar application, irrigation regime and their interaction on some fiber quality traits of cotton plants in 2004 and 2005 seasons.

Characteristic	Fiber finenesse micronaire			Pressley index			length2.5 % SL (mm)			Fiber length uniformity ratio		
Irrigation Regime / Methanol concentration	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average
1. Season 2004												
0	4.17	4.05	4.11	9.57	9.07	9.32	30.00	29.22	29.61	86.35	84.45	85.40
5	4.13	4.03	4.08	9.70	9.07	9.39	29.25	29.30	29.28	85.40	85.12	85.26
10	4.03	4.05	4.04	9.87	9.13	9.50	30.12	29.60	29.86	86.80	86.19	86.50
15	4.07	4.07	4.07	9.90	9.80	9.85	30.33	30.20	30.27	87.20	87.22	87.21
20	4.17	4.10	4.14	10.13	10.00	10.07	30.56	30.32	30.44	87.33	87.35	87.34
Average	4.11	4.06		9.83	9.41		30.05	29.73		86.62	86.07	
LSD at 5% for Treatments	N.S.		0.10	N.S.		0.33	N.S.		0.15	N.S.		0.12
Interaction	0.28			0.47			0.90			0.12		
2. Season 2005												
0	4.21	4.00	4.11	9.63	9.33	9.48	30.13	29.40	29.77	88.23	85.17	86.70
5	4.33	4.10	4.22	10.23	9.67	9.95	29.97	29.47	29.72	86.90	86.63	86.77
10	4.42	4.22	4.32	10.27	9.90	10.09	30.33	29.73	30.03	87.53	87.03	87.28
15	4.54	4.33	4.44	10.30	10.20	10.25	30.60	30.50	30.55	88.50	87.53	88.02
20	4.72	4.51	4.62	10.47	10.40	10.44	30.87	30.57	30.72	89.50	87.97	88.74
Average	4.44	4.23		10.18	9.90		30.38	29.93		88.13	86.87	
LSD at 5% for Treatments	N.S.		0.17	N.S.		0.23	N.S.		0.77	N.S.		0.23
Interaction	0.25			0.33			0.87			0.95		

II- Irrigation effect

No significant effect of Irrigation intervals was observed on fiber fineness and strength in both seasons.

III- Interaction

Fiber fineness, strength and length were significantly influenced by the interaction between methanol foliar application and Irrigation intervals. Values of all the previous characters were increased as Irrigation intervals decreased and methanol spraying concentration increased up to 20 % in both seasons.

Generally, the favorable watering conditions (15 days Irrigation interval) and the proper amounts of methanol 20 % V/V seems necessary to obtained the positive effect of methanol on productivity of the treated crop plant.

D- Chemical constituents of leaves and seeds

I- Methanol effect

The effect of methanol foliar application on chlorophyll, carbohydrates, polyphenol contents of leaves, oil % and protein % of cotton seed are recorded in Table (4).

The Data show significant increase in chlorophyll contents (a, b and total), carbohydrates (reducing sugar and total soluble sugars) and phenols (polyphenols and total phenols), such increase in chlorophyll due to methanol application might be attributed to the beneficial effect of methanol (20 %) in activation of photosynthetic rate and increase in carbohydrate production and distribution to form more growing bolls and to decrease boll shedding.

Similar trend was reported by Makhdum et al. (2002). Also, methanol applications had significant effects on protein and oil percentages in seeds. Data revealed that the higher contents observed due to the application treatment by 20 % methanol.

II- Irrigation effect

Irrigation intervals exerted a significant effect on leaves contents of chlorophyll, carbohydrates and phenols, which were higher in normal (15 days) irrigation intervals than in longer (21 days) irrigation intervals.

Also, irrigation decreased cotton leaves contents of reducing sugars, total soluble sugars, polyphenols and total phenols. These results, are in agreement with those of Kassem and Alia (2003), who reported that water stress decreased chlorophyll content in cotton leaves and hence, reduced their photosynthetic rate.

Oil and protein percentages were higher under 15 days irrigation intervals treatment than under 21 days irrigation interval treatment.

III- Interaction

Cotton leaves contents of chlorophylls, carbohydrates and phenols were significantly influenced by interaction between the two studied factors, values of all the previous characteristics increased as irrigation intervals inecreased and methanol concentration increased up to 20 % and also, oil and protein percentages in seeds were higher in plants irrigated every 15 day and sprayed with methanol.

Table 4. Effect of methanol foliar application, irrigation intervals and their interaction on chemical constitutes of leaves and seeds of cotton plants in 2005 season.

Characteristic	Chlorophylls (mg / gm dry weight)									Carbohydrates (mg / gm dry weight)					
	Chlorophylls a			Chlorophylls b			Total Chlorophylls			Reducing sugar			Total soluble sugar		
Irrigation Intervals / Methanol concentration	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average
0	4.30	3.21	3.76	2.43	2.12	2.28	6.73	5.33	6.03	15.55	12.84	14.20	20.71	17.23	18.97
5	4.34	4.27	4.31	2.55	2.25	2.40	6.89	6.52	6.71	16.55	13.58	15.07	21.58	18.28	19.93
10	4.50	4.33	4.42	2.59	2.30	2.45	7.09	6.63	6.86	17.39	13.52	15.46	22.57	18.31	20.44
15	4.64	4.52	4.58	2.80	2.35	2.58	7.44	6.87	7.16	17.72	14.28	16.00	22.95	19.08	21.02
20	4.94	4.67	4.81	2.97	2.40	2.69	7.91	7.07	7.49	18.50	16.45	17.48	24.47	21.29	22.88
Average	4.54	4.20		2.67	2.28		7.21	6.48		17.14	14.13		22.46	18.84	
LSD at 5% for Treatments	0.04		0.05	0.05		0.09	0.06		0.09	0.24		0.38	0.38		0.61
Interaction	0.07			0.12			0.13			0.53			0.09		

Irrigation Intervals / Methanol concentration	Phenols (mg / gm dry weight)						Oil %			Protein %		
	Polyphenols			Total phnols								
	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average	15 day	21 day	Average
0	6.23	5.42	5.83	8.78	8.22	8.50	20.84	18.39	19.32	20.75	19.42	20.09
5	7.31	6.07	6.69	10.01	8.65	9.33	21.05	18.56	19.81	20.54	20.33	20.44
10	7.55	6.43	6.99	10.18	9.12	9.65	21.66	18.78	20.22	20.60	20.44	20.52
15	7.90	6.99	7.45	10.28	9.83	10.06	22.87	19.95	21.26	22.67	20.54	21.61
20	8.32	7.26	7.79	10.45	9.94	10.20	23.46	21.10	22.25	22.88	21.75	21.82
Average	7.46	6.43		9.94	9.15		21.98	19.36		21.49	20.50	
LSD at 5% for Treatments	0.23		0.36	0.17		0.27	0.72		1.42	0.40		0.32
Interaction	0.04			0.39			0.80			0.46		

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تأثير رش الميثانول تحت مستويين من الرى على إنتاجية القطن

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بسدس – محافظة بنى سويف خلال موسمى ٢٠٠٤ – ٢٠٠٥ ، لدراسة مدى إستجابة نباتات القطن صنف جيزة ٨٠ للـرش بالميثـانول تحـت مستويين من الرى (الرى كل ١٥ يوم وكل ٢١ يوم) ، وإستخدم الميثـانول رشـا علـى النباتـات بتركيزات (صفر ، ٥ ، ١٠ ، ١٥ ، ٢٠ %) مرة واحدة عند بداية التزهير. ويمكن تلخيص النتـائج فيما يلى:

أدى رش الميثانول بصفة عامه إلى زيادة فى كل من الصفات الأتية :

عدد الأفرع الثمرية / نبات ــ عدد اللوز المتفتح / نبات ومتوسط وزن اللوزة ــ معامل البذرة (وزن المائة بذرة) ــ النسبة المئوية للشعر ــ محصول القطن الزهر قنطار/ فدان ــ نعومه ومتانـة وطول الشعيرات عن معاملة المقارنة. وكانت أفضل معامله الرش بالميثانول بتركيز ٢٠ % فى بداية التزهير حيث أعطت زيادة فى محصول القطن الزهر قـدرها ٣٠,٢٩ % ، ٢٤,٤١ % فـى كـلا الموسمين على التوالى بالنسبة للمقارنة.

أدى رش الميثانول إلى زيادة معنوية فى محتوى الأوراق من الكلورفيل (a , b) والكلورفيـل الكلى وكذلك الكربوهيدرات والفينولات العديدة والتى إنعكست على الزيادة فى عدد اللـوز المتفـتح ومتوسط وزن اللوزة وبالتالى الزيادة فى المحصول. وكذلك زيـادة محتـوى البـذرة مـن الزيـت والبروتين وكانت الزيادة واضحة بتركيز ٢٠ % ميثانول عن بقية التركيزات.

أدت زيادة فترات الرى من ١٥ إلى ٢١ يوم إلى نقص معنوى فى كل من عدد الأفرع الثمرية / نبات ودليل مساحة الأوراق (LAI) والوزن النوعى للأوراق (SLW) وعدد اللوز المتفـتح / نبـات ومتوسط وزن اللوزة ومعامل البذرة والنسبة المئوية للشعر والمحصول قنطار / فدان وصفات التيلـة وكذلك محتوى الأوراق من الكلورفيل والكربوهيدرات والفينولات العديدة ومحتوى البذرة من الزيت والبروتين.

أدى الرش بالميثانول تحت ظروف التعطيش (الرى كل ٢١ يوم) إلى خفض الضرر الناجم عن التعطيش فى زيادة محتوى الأوراق من الكلورفيل والكربوهيدرات والفينولات العديدة مما أنعكس ذلك على عدد اللوز المتفتح / نبات ومتوسط وزن اللوزة وبالتالى المحصول قنطار / فدان.

أدى التفاعل بين فترات الرى والميثانول (٢٠ % ميثانول والرى كل ١٥ يـوم) إلـى زيـادة معنوية فى جميع الصفات المدروسة عن معاملة المقارنة.